Name ___________________________ Partners ___________________ _____________________

Date ________ ____________________

AP Physics 1 2017/18

Vector Bug Lab - Vectors take you from here to there

Background:

Vectors are a fundamental principle of physics. Vector quantities tell you a *magnitude* of a quantity (such as force or speed) and the *direction* of the quantity (such as 40 degrees west of south). Vectors are extremely important in navigation and determining how various forces act on a single object. It is important to remember that vector components can be added "head to tail" to get a resultant. Also, any vector can be broken down into its X and Y *components* using trigonometry and/or the Pythagorean theorem. Remember that to negate a resultant vector, one can determine an equilibrant, which is a vector of the same magnitude as the resultant but is opposite in direction. There are several ways to determine the solution to vector problems, including the parallelogram method, the trig. method, and the graphing method. In this activity you will need to use both the trig. method and the graphing method to solve a vector problem.

Assume that you see a bug (Billy the Bug - although technically if Billy's a cockroach, he would not be a true 'bug' in a biology sense) innocently traveling across this room's floor when suddenly someone turns on the lights and it has to run for its life. Since many insects have an internal magnetic "compass", they are aware of their direction relative to north.

Procedure:

PART 1) You will need to graphically plot out where your bug goes using tape to show the bug's path along the floor; you will also need to show and measure the resultant vector. You will need to show this to your teacher when you have the resultant vector plotted out. **Make sure Mr. McChesney checks this off.** *BE CAREFUL: Make sure you know which orientation is North in our classroom, and make sure you have enough room to tape out Billy Bug's path!*

Also note: The first group to get its resultant taped out and plotted *within 3.0 cm and 5.0 degrees of the actual resultant* will get 3 bonus points for each person. The second group will get 2 bonus points per person, and the third group will get 1 bonus point per person.

PART 2) You will also need to use trigonometry and show your solution to the same problem using trigonometry on the back of the page. You may use the graph paper on the back to act as a coordinate system to help you get your answer. You must show all work.

Remember, the symbol Δ means "change in"

DATA FOR YOUR BILLY-BUG

i) Your bug runs at 10.0 cm per second for 3.5 seconds in the direction of 45 degrees north of east. ----> Δ position covered during this step = ___________

ii) Your bug runs at 8.0 cm per second for 5.0 seconds in the direction of 30 degrees south of east ----> Δ position covered during this step = ___________

iii) Your bug runs at 15.0 cm per second for 3.0 seconds in the direction of 60 degrees east of north. ----> Δ position covered during this step = ___________

iv) Your bug runs at 12.0 cm per second for 2.5 seconds in the direction of 75 degrees south of west. ----> Δ position covered during this step = ___________

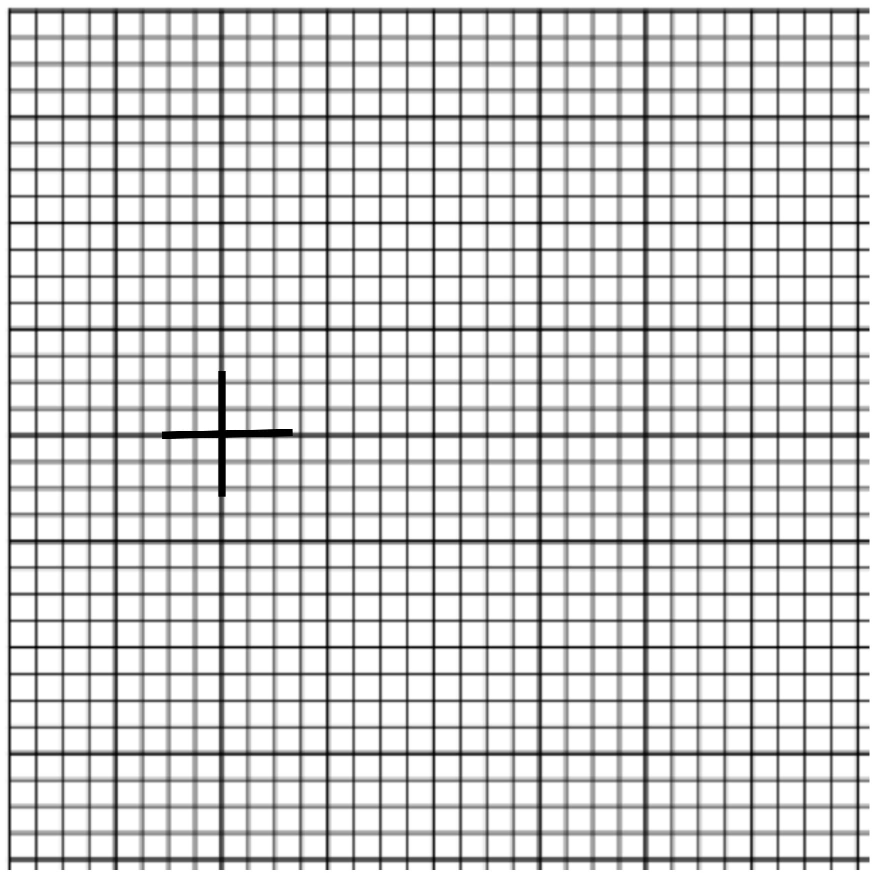
PART 1a) Graphing on the floor (with tape)

Your resultant on the floor = _________ cm at ________ degrees _________ of _________.

Teacher check off and bonus points (if any) _________________________

Hint: 20 cm on the ground = 1 cm on the graph will work well. Start at the 'crosshairs' in order to stay on the page.

PART 1b) Graphing on paper. Plot the movement of your bug on the graph to the right using arrows. Make sure to indicate your scale relating the bug's actual motion to this graph unless it's the one noted. Also draw your resultant



Part 2) Trigonometry. You may want to set up a table similar to the one below to determine the vertical and horizontal components of each vector. (Remember, you don't have to use "north" and "east")

NORTH	EAST	
		TOTALS

Show ALL trig. calculations on this page <u>or</u> an attached sheet of paper!!!(You should have one set for each leg of the journey!)
Also draw out the triangles

Your trigonometry resultant = _________ cm at ________ degrees _________ of _________. Again, show your work

QUESTIONS:

1) Determine the relative error of your resultant for each method based on the correct resultant being _________ cm.
(Show calculations for magnitude only, not angle)

% error for graphing on the floor = _________

% error for trig. = ________

2) Which method (graphing or trig.) was better for *this* problem? (Consider relative errors, time consumption, etc.) EXPLAIN your answer.